SOME NOTES ON THE LIFE HISTORY OF *CRYPTOCEPHALUS 6-PUNCTATUS* L. (COL.: CHRYSOMELIDAE)

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ON A JOINT VISIT to a site near Stockbridge, Hampshire on 25.vi.93, my friend Ian Menzies beat from hazel *Corylus avellana* a female *Cryptocephalus sexpunctatus* which he generously presented to me. During the next week or so she laid a number of eggs from which larvae, pupae and, ultimately, further adults were obtained. These notes present observations made in rearing the species through two generations, a process which occupied three years. As in the case of other members of the genus *Cryptocephalus,* complete development of the beetle from egg to adult takes place within a capsule formed from faecal material and enlarged as growth occurs. Rearing the species in captivity revealed the relation of this encapsulation to development and demonstrated other aspects of its life history not easily observed in the wild.

Eggs and egg-laying

The females were kept in glass jars covered with netting and given hazel leaves which they nibbled almost continuously. The captured specimen had apparently mated before capture for she was laying eggs which proved fertile within a few days of capture. Mating was not observed with the reared specimens but they started egg-laying within a few days of emerging.

While laying eggs, the beetle hangs from a leaf or stem, producing an egg at intervals and holding it with her hind tarsi against an excavation on the apical sternites. She then extrudes faecal material which she moulds around the egg using her hind tarsi forming a strongly carinated, mildly elongated capsule (Plate A, Fig. 1). The encapsulated egg is then dropped and the process continued with the next egg.

The captured female laid only about 20 eggs in captivity but she may have laid many more in the wild before capture. Some of the eggs were without faecal cover, possibly because one of her hind legs was damaged. These uncoated eggs produced living larvae but the latter did not survive. The two first-generation females laid about 160 eggs between them during a period of about two weeks. Unfortunately, most of these eggs were accidently discarded but about 30 were saved.

Larvae

The eggs hatched in about three weeks. the newly hatched larvae remained within the faecal coating of the egg which formed the start of the larval capsule. They were supplied with hazel leaves in which they ate small holes. When they were about ten days old, they stopped crawling about and eating for about a week. Then head cases appeared in the container indicating that they had moulted. They then started eating again. Eight weeks later they again stopped eating and crawling about. A set of larger head cases appeared in the container a week later and the larvae started feeding again. Increase in capsule size involved the larva making a longitudinal slit in the wall of the capsule, expanding it a little and then plugging the gap with more faecal material. For a day or so afterwards, the position of the filled gap showed as a lighter streak along the capsule. As capsules grew in size, weak longitudinal ridges developed, possibly related to the process of their expansion. By the time the larvae had become full-grown, the capsules measured 7-8mm in length and 3.5-4mm in diameter (Plate A, Fig. 2).

Larvae from the captured female continued to eat until the end of October 1993 but then stopped eating and became more or less inactive. Up until that time, they had been kept in containers indoors but they were then put into winter quarters outside. The latter consisted of squat jars with perforated screw-cap lids, containing a layer of moistened sand 2-3cm deep and a few withered hazel leaves. The containers were placed in a cold part of the garden with a raised plastic cover over the containers to keep out the rain. The larvae spent most the winter within the curled up leaves. As spring and summer ensued, they gradually became active, nibbling first hazel catkins, then withered hazel leaves and finally fresh hazel leaves.

The larvae continued feeding throughout the summer of 1994. By October, however, they had become much less active and were put outside into the same winter quarters as they had had the previous winter. Most of the time throughout the winter they lay motionless within curled up withered leaves.

In early spring 1995, they were seen to have moved on occasions but not to eat. Towards the end of March, they took up positions in curled up,

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PLATE B: opposite

Fig.1. Eggs of *C. sexpunctatus* showing a coating of faeces from the female. sculpted into carinae by her hind tarsi.

The encapsulated eggs measure approximately 0.12 x 0.08mm.

Fig.2. Larva, showing head and front legs extruded from its capsule. When the head and legs are withdrawn into the capsule, the flattened front of the head seals the entrance. The well-developed front legs provide sufficient traction to make the encapsulated larva quite mobile on more or less level surfaces. The full-grown capsules measure 7-8mm in length and 3.5- 4.0mm in diameter.

Fig.3. Empty pupal chamber. Before pupating, the larva has attached the open end of the capsule to a dried leaf with a few silk threads and then sealed the opening. The adult has escaped from the opposite end of the capsule by cutting round to form a hinged cap.

Fig.4. Adult female *C. sexpunctatus*: length of females 5.5-6.5mm; males 5.0-6.0mm.

Fig. 1

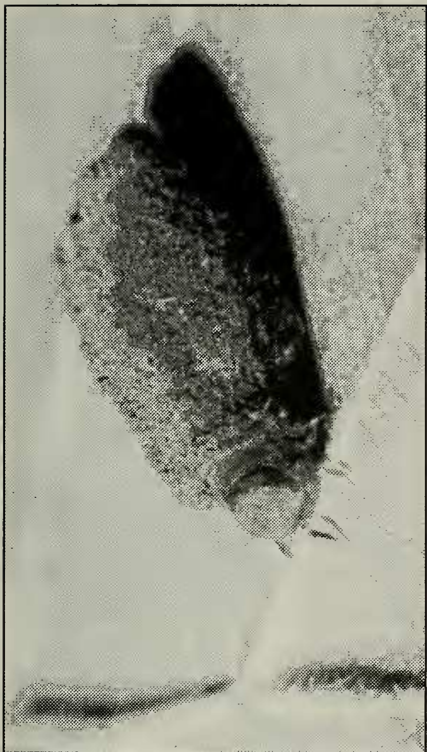

Fig. 2

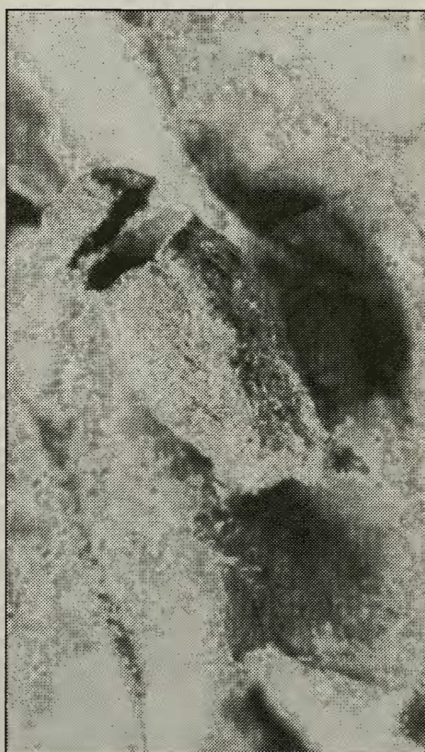

Fig. 3

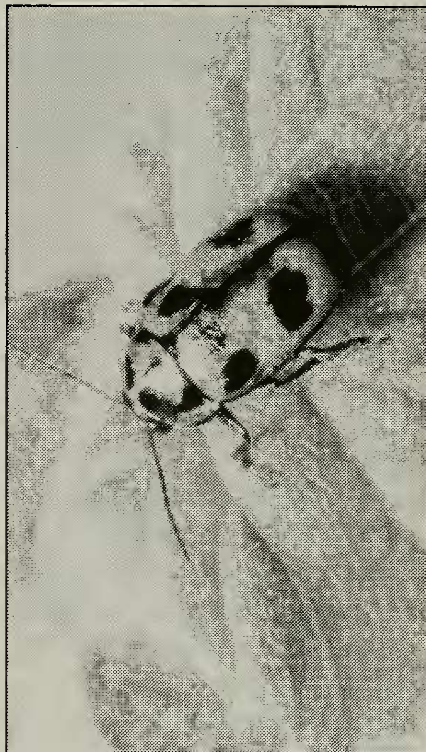

Fig. 4

PLATE B

withered hazel leaves and fastened their capsules to the leaves with short silk threads. Afterwards, the mouth of the capsule was sealed and it was presumed that pupation occurred shortly after this. A capsule cut open at this stage showed a pupa with its head pointing away from the attached end. The containers were left outside in a position where they were warmed by the sun until the adults emerged.

Larvae from the first captive generation behaved similarly but took only one summer to become full-grown. They were put into winter quarters at the beginning of November 1995. As with the first generation larvae, they remained inactive until March of the following year when they fastened their capsules to withered leaves and pupated.

Adults

Adults emerged from the capsule by cutting round what had been the closed end of the larval capsule to make a hinged cap (Plate A, Fig. 3). In 1995, four adults of the first captive generation (two males, followed by two females) emerged at the end of April. These were obtained from seven larvae put outside to overwinter in November the previous year. One of the males died a few days after emerging. The other and the females lived for several weeks. A photograph of an adult female is shown in Plate A, Fig. 4.

In 1996, twelve adults of the second captive generation (three males and nine females) emerged during the last week of April and the first two weeks of May. These were the product of fifteen larvae put outside in October 1995. As with the previous generation, the males emerged first. For unknown reasons, all three males, together with the first female to appear, died within a few days of emerging. The remaining eight, however, appeared healthy and lived in a large glass container for several weeks, nibbling fresh hazel leaves. Presumably one of the surviving females had mated for only a few uncoated eggs were laid and these proved infertile bringing the colony to an unfortunate end.

A summary of the breeding progress in the two generations is presented in Table 1.

Discussion

The development of the larvae of *Cryptocephalus* and related species in capsules has long been known though the exact nature of the capsule was not appreciated initially. Rye (1866) states that early observers thought that the capsules were formed of earth but that further studies had shown that they comprised faecal material. This study confirms this for *sexpunctatus*. Hinton (1944) states that the outline and sculpture of the egg capsules of different species are sufficiently characteristic in a number of British species to allow identification of the species but he does not mention whether this applies to the eggs of *sexpunctatus*.

Most of what was observed in this study no doubt reflects the life history of the species in the wild. Two questions, however, remain unanswered. The first concerns the duration of the life cycle. The first captive generation took two years to develop while the second took only one year (see Table). This was probably due to larvae of the second generation having a longer growing season the year they hatched because they came from eggs laid towards the end of May rather than from eggs laid at the end of June as in the case of the first set of larvae.

Table 1. Timetable of development of *Cryptocephalus sexpunctatus* in captivity.

Stage	first captive generation	second captive generation
female(s) laying	1st week July 1993*	May to June 1995
1st instar larvae	20 at start of July 1993	30 at end of May 1995#
2nd instar larvae	14 at end of July 1993	20 at end of June 1995
3rd instar larvae	10 at end of September 1993	16 at middle of August 1995
full-grown larvae	6 at end of October 1994	15 at end of October 1995
anchored capsules	6 at end of March 1995	15 by first week of April 1996
adults	2 ♂ & 2 ♀ April/May 1995	3 ♂ & 9 ♀ May 1996

* this was the female captured in the wild.

\# about 160 eggs were laid but most were accidentally discarded.

The second unanswered question is what serves as larval foodplant in the wild. In captivity, larvae were supplied with fresh hazel leaves simply because the captured female was found on hazel. They developed well on this diet but it seems very unlikely that larvae in the wild could reach fresh hazel leaves. The larvae are able to crawl about objects lying on the surface of the ground in spite of the impediment of a capsule but their legs appear designed for traction and, in captivity at least, the larvae showed no evidence that they could climb up a hazel tree. Overwintering larvae were seen occasionally to nibble at withered hazel leaves such as are likely to be available to a larva on the ground on a year round basis but these would have a much lower nutritional value than green hazel leaves. Fallen hazel catkins with a higher nutritional value would be available in the spring but only for a short period. It seems likely, accordingly, that the bulk of the larval nourishment in the wild comes from other sources such as low growing plants. Other trees and bushes on which adults have been found include aspen *Populus tremula* (Ashe, 1921; Cox, 1948), birch *Betula* sp. (Fowler, 1890), crack willow *Salix fragilis* (Cox, 1948), hawthorn *Crataegus* sp. and oak *Quercus* sp. (Koch, 1992) but with none of these are fresh leaves likely to be any more accessible to larvae than those of hazel. Moreover, if the larvae of this species did climb trees to eat fresh leaves, it might be expected that they would have been encountered by entomologists beating the trees for one reason or another but this does not seem to have been recorded. The same remark applies to the larvae of other relatively common *Cryptocephalus* species, such as *labiatus* (Linnaeus), *parvulus* Müller or *pusillis* Fabricius, whose adults occur on the same trees and shrubs.

In the two generations studied, one of two adult males in the first generation died within days of emerging and all three males of the second generation suffered the same fate. The reason for this selective mortality is not known. In both generations, females treated in the same way as the males, lived in captivity for several weeks. It is conceivable that lack of a normal dietary factor (? low growing plants) may have been responsible. Alternatively, the relatively rich diet of fresh hazel leaves may have interfered in some way with proper development. Clearly further studies are desirable and will be attempted but these may well take a few years to perform.

Acknowledgements

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